Chapter 3:
Power Supply Board

3 Power Supply Board

3.1 Overview

The Prism Power Supply Board provides the flexibility to operate the Prism via three separate input circuits. The Power Supply Board is used to generate the regulated DC voltages that are used throughout the monitor. Battery monitoring and charging are also accomplished on the Power Supply Board by use of a programmable microcontroller. The ESCORT II is equipped with a thermistor-controlled cooling fan which only turns on when the internal temperature exceeds 45° C.

The available outputs are +5, ±15, -17, and +24V DC.

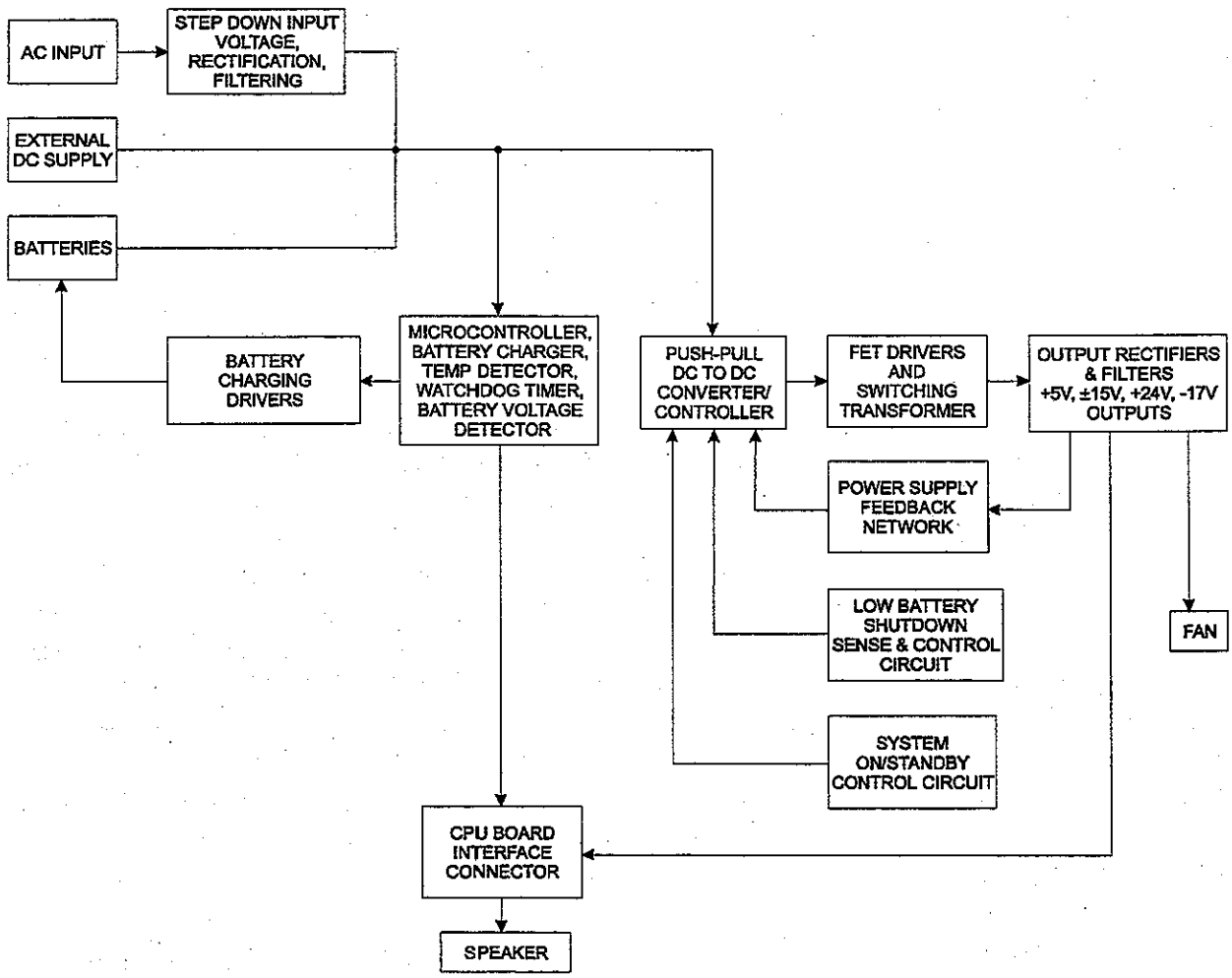

AC INPUT
STEP DOWN INPUT VOLTAGE, RECTIFICATION, FILTERING
EXTERNAL DC SUPPLY
BATTERIES
BATTERY CHARGING DRIVERS
MICROCONTROLLER, BATTERY CHARGER, TEMP DETECTOR, WATCHDOG TIMER, BATTERY VOLTAGE DETECTOR
PUSH-PULL DC TO DC CONVERTER/ CONTROLLER
FET DRIVERS AND SWITCHING TRANSFORMER
OUTPUT RECTIFIERS & FILTERS +5V, ±15V, +24V, -17V OUTPUTS
POWER SUPPLY FEEDBACK NETWORK
LOW BATTERY SHUTDOWN SENSE & CONTROL CIRCUIT
FAN
SYSTEM ON/STANDBY CONTROL CIRCUIT
CPU BOARD INTERFACE CONNECTOR
SPEAKER

Figure 3-1: Prism Power Supply Block Diagram

3.2 Input Circuits

The PRISM bedside monitor can be powered by AC, internal batteries, or an external DC power source. Each of these methods are described in the following paragraphs.

3.2.1 AC Power

When using AC power, [V+] and [VRAW] are formed using the monitor's internal power transformer which provides line current isolation and steps the voltage down to approximately 17 VAC. L1 is used for common mode rejection (CMR) and full wave bridge rectifier, BR1, provides pulsating DC to an LC circuit consisting of L2, C25 and C26 forming the DC level. C3, C4, C6, C7, and C8 provide filtering at each stage.

The [AC DET] signal is extracted from BR1 and is used by the system CPU board to determine the line frequency. This signal is also used to illuminate the [AC LED] on the front panel.

3.2.2 Batteries

When the PRISM is operated with the internal batteries, the batteries provide the capability of mobile monitoring. Two (2) 12 VDC batteries are installed in the rear of the unit. The positive terminals of the batteries are wired OR'd together to provide operating voltage from one or both batteries. The battery current flows through L3 and TH1. TH1 is a *Positive Temperature Coefficient (PTC)* resistor which functions as a current switch that will open the current path in the event of an over current condition. TH1 will remain open until the source has been removed. C10 functions as a storage capacitor and C9 provides filtering while producing [V+].

3.2.3 External DC Supply

The external DC input circuitry also creates [V+]. Two blocking diodes, D5 and D7, provide double protection against reverse polarity inputs. TH1 is used for over-current protection as described above. C10 is used as a storage capacitor and C9 provides filtering. This input accommodates 12-28 Volts DC and is rated at 45 VA.

3.3 Output DC Voltage Development

The Power Supply is activated with [ON SW] which applies a ground reference to the solid-state relay, K1-5. The application of the ground to K1-5 closes the contacts between K1-3 and K1-4 allowing the input [V+] to pass to the output on K1-4 creating [VA]. [VA] is applied to the voltage regulator, U10-3. The output of U10 (+12V) is the *turn on* voltage to the pulse width modulator, U3.

The pulse width modulator, U3, is biased with C19 and R20 to provide a 200 kHz free oscillating frequency. C23, R41 and R24 compensate for and stabilize the frequency. [PS SYNC] on U3-3 is a 250 kHz synchronizing input signal from the CPU board that will preempt the internal oscillator after the power up sequence is complete. This signal assists in reducing beat frequency noise on ECG and other circuits by switching all internal power supplies on the same edge. C18, connected to U3-8, slowly charges and provides a soft start at power up. The modulated outputs from U3-11 and U3-14 drive the high power MOSFETs, Q1 and Q2. They in turn drive the custom wound transformer, T1. Zener diodes, D3 and D4, provide spike protection for Q1 and Q2. Through mutual inductance the voltages are transferred to the secondary of the transformer, T1. The voltages derived from T1 are [VX], +24V, -17V, +5V, +15V and -15V.

Diodes D24 and D25 rectify the voltage between T1-2 and T1-3. L4F and C37 convert the pulsating DC to a steady DC level, creating [VX] which is used to power the pulse width modulator. Therefore, after [ON SW] is momentarily applied, [VX] will supply the operating voltage for U3.

RT1 is a thermistor used to keep -17V constant as the internal temperature of the monitor changes.

The +5V is used to power most of the solid state devices used in the monitor. It is sampled by the pulse width modulator U3-1 for voltage regulation. Using an internally generated 5.1V reference voltage [VREF], U3 will compare the +5V output and vary the duty cycle of its outputs at U3-11 and U3-14 to maintain the +5V output.

Each of the output circuits has separate rectification and LC circuits to provide DC voltages. Using the +15V output as an example, D15 is used to rectify the voltage from T1, and an LC circuit consisting of L4A and C27 converts the pulsating DC to a steady DC level. C28 filters high frequency noise from the DC voltage and R26 serves as a load or bleeder resistor. The other outputs have similar circuits.

The power supply is deactivated with [STANDBY] which applies a ground reference to the relay K1-6. The application of the ground to K1-6 opens the connection between K1-3 and K1-4 and closes the contacts between K1-8 and K1-9. This applies a ground potential to pin 8 of U3 and turns the pulse width modulator off.

A low voltage detection and shutdown circuit is formed by comparing [VA] to [VREF] using comparators U5A and U5B. If [VA] falls below 8.3V, U5B-7 will apply a ground potential to U3-8 and turn the modulator off.

3.4 Battery Charging

The batteries are charged using the programmable microcontroller, U8. A crystal oscillator X1 provides a 16 MHz input frequency. [VIN] on U8-13 and [VBAT1 and VBAT2] on U8-14 and U8-15 are used to determine the battery potential and provide information used in the battery charging algorithm. U9 monitors the ambient temperature inside the PRISM monitor and applies [VTEMP] to U8-16. When the temperature increases, the battery charge voltage is reduced to prevent battery overheating. Using this variable in the battery charging algorithm extends battery life. [CHRG_SYN] is a 15.625 kHz signal that is used to keep battery charging in sync with the other subsystems in the PRISM.

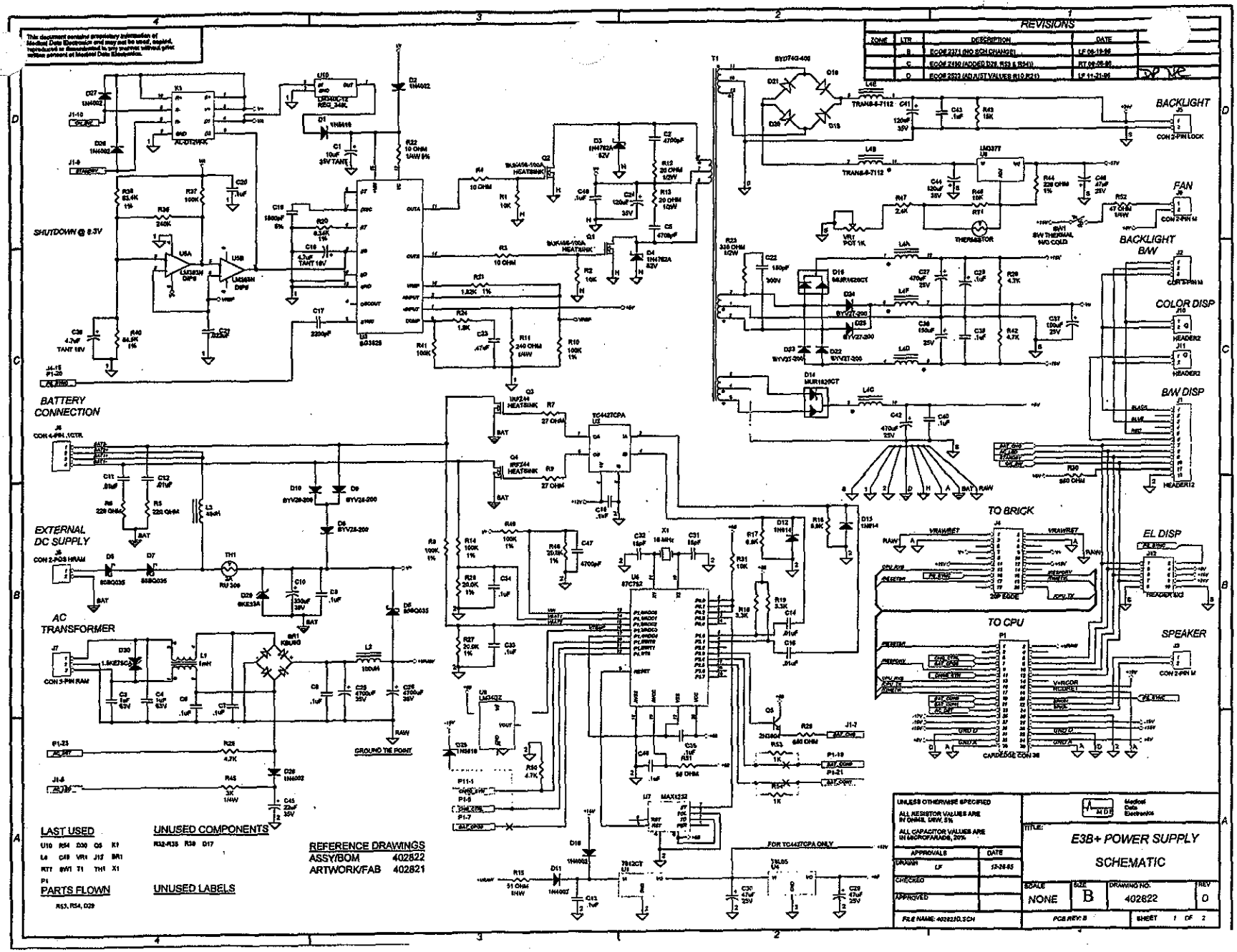
[CHG_CTRL] is used by the system CPU board to disable battery charging when the recorder is in use. Battery charging is disabled while the recorder is in use to reduce total current consumption. When the unit is in *standby*, the absence of [CHRG_SYN] will trigger charging at approximately 400 mA.

The watchdog timer, U7, monitors a strobe output from U8-23. If the strobe stops, the timer will time out and reset U8. The outputs of U8-4 and U8-5 provide a pulse width modulated output current through buffer U2 to MOSFETs Q3 and Q4 for battery charging. The battery charging current is filtered using RC circuits consisting of C11-C12 and R5-R6. When battery charging stops, the magnetic field around L1 collapses and induces current into the circuit. Diodes D8-D10 provide a path for this current back to the source. The output of U8-2 is used to forward bias Q5 and create [BAT_CHG], which is used to illuminate the battery charging LED on the front panel. U8 also determines the battery condition and reports this information to the system CPU board using [BAT_CON0] and [BAT_CON1]. See Table 3-1 for details.

[VRAW] or +15V is regulated down to +12V by U1. The +12V provides the operating voltage for U2. The +12V is regulated down to +5B by U4. The +5B provides the operating voltage for U7, U8, U9 and Q5. It is necessary to develop these voltages for the operation of U2, U7, U8, U9, and Q5 when the PRISM bedside monitor is in the *standby* mode.

Table 3-1: Battery Conditions

BAT_CON0 (U8-1)	BAT_CON1 (U8-27)	ESCORT II Battery Condition	Battery Level
0	0	Very Low (Intermittent alarm tone sounds)	Approximately 10 minutes of battery life remains
1	0	Low	< 20% Charge
0	1	Mid	20-60% Charge
1	1	High	> 60% Charge


REVISIONS
ZONE | LTR | DESCRIPTION | DATE
B | ECO# 2371 (NO SCH CHANGE) | LF 06-19-95
C | ECO# 2390 (ADDED D28, R53 & R541) | RT 08-25-95
D | ECO# 2523 (ADJ R/T VALUES R10,R31) | LF 11-21-95
BACKLIGHT
FAN
BACKLIGHT B/W
COLOR DISP
B/W DISP
EL DISP
SPEAKER
TO BRICK
TO CPU
BATTERY CONNECTION
EXTERNAL DC SUPPLY
AC TRANSFORMER
SHUTDOWN @ 8.3V
LAST USED
UNUSED COMPONENTS
R32-R35 R39 D17
REFERENCE DRAWINGS
ASSY/BOM 402822
ARTWORK/FAB 402821
PARTS FLOWN
R53, R54, D29
UNUSED LABELS
UNLESS OTHERWISE SPECIFIED
ALL RESISTOR VALUES ARE IN OHMS, 1/8W, 5%
ALL CAPACITOR VALUES ARE IN MICROFARADS, 20%
APPROVALS
DRAWN LF 12-28-95
CHECKED
APPROVED
TITLE:
E3B+ POWER SUPPLY
SCHEMATIC
SCALE NONE
SIZE B
DRAWING NO. 402822
REV 0
FILE NAME: 402822D.SCH
PCB REV: B
SHEET 1 OF 2

402822-0000 PCBA, E3B PLUS POWER SUPPLY

MDE Part Number	Description	Quantity	Reference
352100-0150A	CAP, 15PF,50V,10%,RAD,NPO EDPT TAPE & REEL	2	C31,32
352102-0151A	CAP, 150pF,20%,400VAC,2500V,CS,CER DISC,INT'L APPR	1	C22
352200-0127A	CAP, 120uF,35V,20%,LOW ESR,.15/.35,ELECT	3	C24,41,44
352200-0157A	CAP,150uF,25V,20%,RAD,ELECT,8mm x 12mm,3.5mm LD	1	C38
352200-0226A	CAP, 22UF,63V,RAD,ELECT 2.5mm LEAD SPACE TAPE&REEL	1	C45
352200-0476A	CAP, 47UF,25V,ELECT,G.P.,2.5mm LEAD SPACE	3	C29,30,46
352201-0477A	CAP, 470uF,25V,20%,LOW ESR,RAD,ELECT	2	C27,42
352201-0478A	CAP, 4700 UF, 35V, ELECT. (18X40MM) **BULK**	2	C25,26
352202-0107A	CAP, 100uF,20%,25V,6.3x11mm,RAD,ELECT	1	C37
352202-0337A	CAP, 330UF,35V,10X16MM,ELECT,RAD	1	C10
352300-0010A	CAP., 1000pF,5%,MYLAR SORT FROM 352300-0007A	1	C19
352300-0103A	CAP, .01UF,50V,20%,RAD,MYLAR	4	C11,12,14,16
352300-0104A	CAP, .1UF,50V,20%,RAD,MYLAR	0	C33,34,35,39,40,43,48
352300-0104A	CAP, .1UF,50V,20%,RAD,MYLAR	1	C49
352300-0104A	CAP, .1UF,50V,20%,RAD,MYLAR	15	C6,7,8,9,13,15,20,28
352300-0223A	CAP, .022UF,50V,20%,MYLAR	1	C21
352300-0472A	CAP, 4700pF,50V,20%,MYLAR,RADIAL, LEAD SPACE .1IN	3	C2,5,47
352300-0474A	CAP, .47UF, 50V,20%,RAD,MYLAR(METALLIZED POLYESTR)	1	C23
352301-0105A	CAP, 1UF,63V,20%,MYLAR	2	C3,4
352301-0222A	CAP, 2200PF,50V,20%,MYLAR	1	C17
352400-0475A	CAP, 4.7UF,16V,20%,RAD,TANT	2	C18,36
352401-0106A	CAP, 10UF,35V,20%,RAD,TANT TAPE & REEL	1	C1
354000-0085A	CONN, 3-PIN,M,STRT LCK,.156 CTR	1	J2
354000-0138A	CONN, 2-P,M,STRT LOCK,.1 CTR,HDR	2	J3,9
354000-0148A	CONN, 4-P,M,STRT,.1 CTR,LOCKING RAMP	1	J8
354000-0192A	CONN, 2-POS,HDR,RT ANGLE, MALE	1	J6
354000-0200A	CONN, 20-PIN,EDGE,DUAL 10	1	J4
354000-0222A	CONN, 2-PIN,LOCKING	1	J5
354000-0314A	CONN, 5-PIN,F,DUAL ROW,.1 CTR	1	J12
354000-0318A	CONN, 3-PIN,M,R/A,.156 SPCNG,LOCKING	1	J7
354000-0330A	CONN, 12-PIN,DUAL ROW,FLT CBL	1	J1
356000-0026A	XTAL, 16MHZ, LOW PROFILE, .142IN X .425IN	1	X1
358100-0013A	SCR, 4-40 X 3/8,PH PNHD,ZINC	2	5
358100-0153A	SCR, 4-40 X 7/16 PHL PNHD SS	2	16
358200-0001A	WSHR, SHLDR	2	9
358200-0004A	WSHR, #4 FLAT STL ZINC,(.125ID,9/32OD,.025THK)	2	10
358200-0009A	WSHR, #4 SPLIT LOCK	4	11
360500-0022A	NUT, #4 HEX,LRG PTTRN	2	12
360500-0046A	SPCR, SWAGE #4 X 1/8IN LG X .188 SHANK X1/4 IN DIA	2	15
360500-0085A	STDOFF, 4-40 x 1/8 IN LG,SWAGE	2	4
360500-0113A	STNDOFF, 4-40 x 1~LG x 1/4~DIA ALUM,SWAGE	2	3
360500-0120A	SPCR, #4 1/4 RND x .75LG x .188 SHNK	1	6
360600-0010A	HTSNK, 5768B	2	14
360600-0046A	HEATSINK, TO-202 & TO-220	2	7
364000-0091A	IC, SG3525A,REGULATING PWM,DIP-16	1	U3
364000-0107A	IC, 7812 CT	1	U1
364000-0109A	IC, 78LO5 +5V REG. TO-92 PKG.	1	U4
364000-0144A	IC, LM393N,DUAL COMP	1	U5
364000-0207A	IC, LM78L12ACZ,+ 12V REG TO92	1	U10

MDE Part Number	Description	Quantity	Reference
364000-0213A	IC, WATCHDOG,8-PIN DIP	1	U7
364000-0224A	S*IC, 87C752 16MHZ(AFTER PROG LBL BC V.01)	1	U8 - NEEDS PROGRAM
364000-0225A	IC, LM34DZ,PRES FAHRENHEIT TEMP SENSOR TO-92	1	U9
364000-0226A	IC, LM337T,3-TERM ADJ NEG REG TO-220	1	U6
364000-0227A	IC, TC4427CPA,DUAL HIGH SPEED MOS FET DRIVER	1	U2
365000-0328A	S*SKT, 28-PIN,PLCC THRU HOLE	1	SU8
370100-0100A	RES, 10,1/4W,5%,CF TAPE & REEL	1	R22
370100-0241A	RES, 240,1/4W,5%,CF TAPE & REEL	1	R11
370100-0302A	RES, 3K,1/4W,5%,CF TAPE & REEL	1	R45
370100-0470A	RES, 47,1/4W,5%,CF TAPE & REEL	1	R52
370100-0510A	RES, 51,1/4W,5%,CF TAPE & REEL	1	R15
370101-0100A	RES, 10,1/8W,5%,CF TAPE & REEL	2	R3,4
370101-0103A	RES, 10K,1/8W,5%,CF TAPE & REEL	4	R1,2,31,46
370101-0104A	RES, 100K,1/8W,5%,CF TAPE & REEL	2	R37,41
370101-0152A	RES, 1.5K,1/8W,5%,CF TAPE & REEL	1	R24
370101-0153A	RES, 15K,1/8W,5%,CF TAPE & REEL	1	R43
370101-0221A	RES, 220,1/8W,5%,CF TAPE & REEL	2	R5,6
370101-0242A	RES, 2.4K,1/8W,5%,CF TAPE & REEL	1	R47
370101-0244A	RES, 240K,1/8W,5%,CF TAPE & REEL	1	R36
370101-0270A	RES, 27,1/8W,5%,CF TAPE & REEL	2	R7,9
370101-0332A	RES, 3.3K,1/8W,5%,CF TAPE & REEL	2	R16,19
370101-0472A	RES, 4.7K,1/8W,5%,CF TAPE & REEL	4	R25,26,42,50
370101-0560A	RES, 56,1/8W,5%,CF TAPE & REEL	1	R51
370101-0561A	RES, 560,1/8W,5%,CF TAPE & REEL	1	R30
370101-0681A	RES, 680,1/8W,5%,CF TAPE & REEL	1	R29
370101-0682A	RES, 6.8K,1/8W,5%,CF TAPE & REEL	2	R17,18
370102-0200A	RES, 20,1/2W,5%,CF TAPE & REEL	2	R12,13
370102-0331A	RES, 330,1/2W,5%,CF TAPE & REEL	1	R23
370200-1003A	RES, 100K,1/4W,1%,MF TAPE & REEL	3	R8,14,49
370200-2002A	RES, 20K,1/4W,1%,MF TAPE & REEL	3	R27,28,48
370200-2260A	RES, 226,1/4W,1% TAPE & REEL	1	R44
370200-6341A	RES, 6.34K,1/4W,1%,MF TAPE & REEL	1	R20
370200-6342A	RES, 63.4K,1/4W,1%,MF TAPE & REEL	1	R38
370200-8452A	RES, 84.5K,1/4W,1%,MF TAPE & REEL	1	R40
370202-1003A	RES, 100K,1/8W,1%,MF TAPE & REEL	1	R10
370202-1821A	RES, 1.82K,1/8W,1% TAPE & REEL	1	R21
370600-0102A	S*RES, 1K,0.1W,5%,0805,SMD	2	R53,54
374300-0102A	POT, 1K,TRIM,SIDE ADJ,CERMET,3/8 IN.QR,.15LS	1	VR1
376000-0003A	XSTR, 2N3904	1	Q5
376000-0017A	XSTR, PWR MOSFET,BUK 455/456-100,TO-220AB PKG	2	Q1,2
376000-0031A	XSTR, IRFZ44,PWR MOSFET,60V,35A,TO-220AB PKG	2	Q3,4
378000-0002A	DIO, 1N4002GP,RCTFR, (MOT ONLY) T&R	6	D2,11,16,26,27,28
378000-0005A	DIO, 1N914,SIGNAL T&R	2	D12,13
378000-0023A	DIO, 80SQ035 8A RECTIFIER(OR 040/045)*BULK ONLY*	1	D7
378000-0033A	DIO, MUR1620CT,200V,16A,RCTFR,ULTRAFAST,COM CATH	2	D14,15
378000-0036A	DIO, 1N5819,1AMP,SCHOTTKY T&R	1	D1
378000-0036A	DIO, 1N5819,1AMP,SCHOTTKY T&R	1	D29
378000-0041A	DIO, BYV27-200 T&R	4	D22,23,24,25
378000-0052A	RECTIFIER, 8AMP BRIDGE 200V	1	BR1
378000-0061A	DIO, 1N4762A,82V,1W,ZENER TAPE & REEL	2	D3,4
378000-0074A	DIO, BYD74G-400	4	D18,19,20,21

MDE Part Number	Description	Quantity	Reference
380000-0033A	SW, THERMAL 45 DEG C,N.O.(COLD),TO220	1	SW1
380000-0035A	SW, RUE300,POLY,RESETTABLE FUSE PTC DEV	1	TH1
380000-0039A	RELAY, 10-PIN,DIP,2FORMC,MICROMINI LATCHING,12V	1	K1
382200-0025A	CHOKE, 1mH,6 AMP,COMMON MODE	1	L1
382200-0026A	CHOKE, 100uH,6 AMP,POWER	1	L2
384000-0118A	THERMISTOR, NTC R=300 OHM	1	RT1
384000-0242A	TRANSIENT VOLT SUPPRESSOR, UNIDIRECT 600W,33V	1	D29
384000-0257A	TRANSIENT VOLTAGE SUPPRESSOR,1500W,75V,BIDIRECT	1	D30
385000-0001A	PVC TUBING,TEFLON(16GA).053IN ID STANDARD WALL	1	13 - 2PCS @ 1/2~LG EA
385000-0048A	INSULATOR, THERMALLY CONDUCTIVE	2	8
401684-0000	GUIDE PIN E3B/E2B REV. B(E1909)	2	2
401828-0000	XFMR, SWITCHING E3B PWR SPPLY REV A3 (D551)	1	T1
401829-0000	MULTI-INDCTR, SWITCHING E3B PWR SPPLY REV A3 (D551	1	L4
401863-0000	FAB.,DIO 80SQ035 8A RECT.(OR 040/045) REV A (D319)	2	D5,6
401864-0000	FAB.,DIO, FE3D,200V,3A,FAST *PREPPED* REV A (D319)	3	D8,9,10
402012-0000	INDCTR,49uh,E2B/E3B P/S BATT CHRGR REV A (E1430)	1	L3
402269-0000	B-SERIES POWER SUPPLY ROM VERS. 1.0.0 (S038)	0	U8
402821-0000	PCB, E3B PLUS POWER SUPPLY REV. B(E2371) *TEST*	1	1

4 CPU Board & Video Configurations

4.1 Overview

The Prism monitor is controlled by the CPU Board. The Central Processing Unit (CPU) used is an 8-bit processor, type Z8S180. The CPU board retains its system configuration in battery backup RAM and generates all timing and synchronization signals to make the ESCORT II monitor an intelligent and efficient monitoring device. The CPU board communicates directly with all parameter cards and configurations through software commands transmitted across a common bus. The CPU board also provides a real-time clock, a watchdog circuit, digital I/O, timer counter circuit, keyboard decoding, 256K x 8 ROM, 128K x 8 RAM, memory decoding, a recorder initialization circuit, alarm tone generator, analog-to-digital and digital-to-analog converters, defibrillator sync, defibrillator interface, outputs to back panel modules, and a display interface.

Both LCD and EL video configurations are discussed later in this chapter.

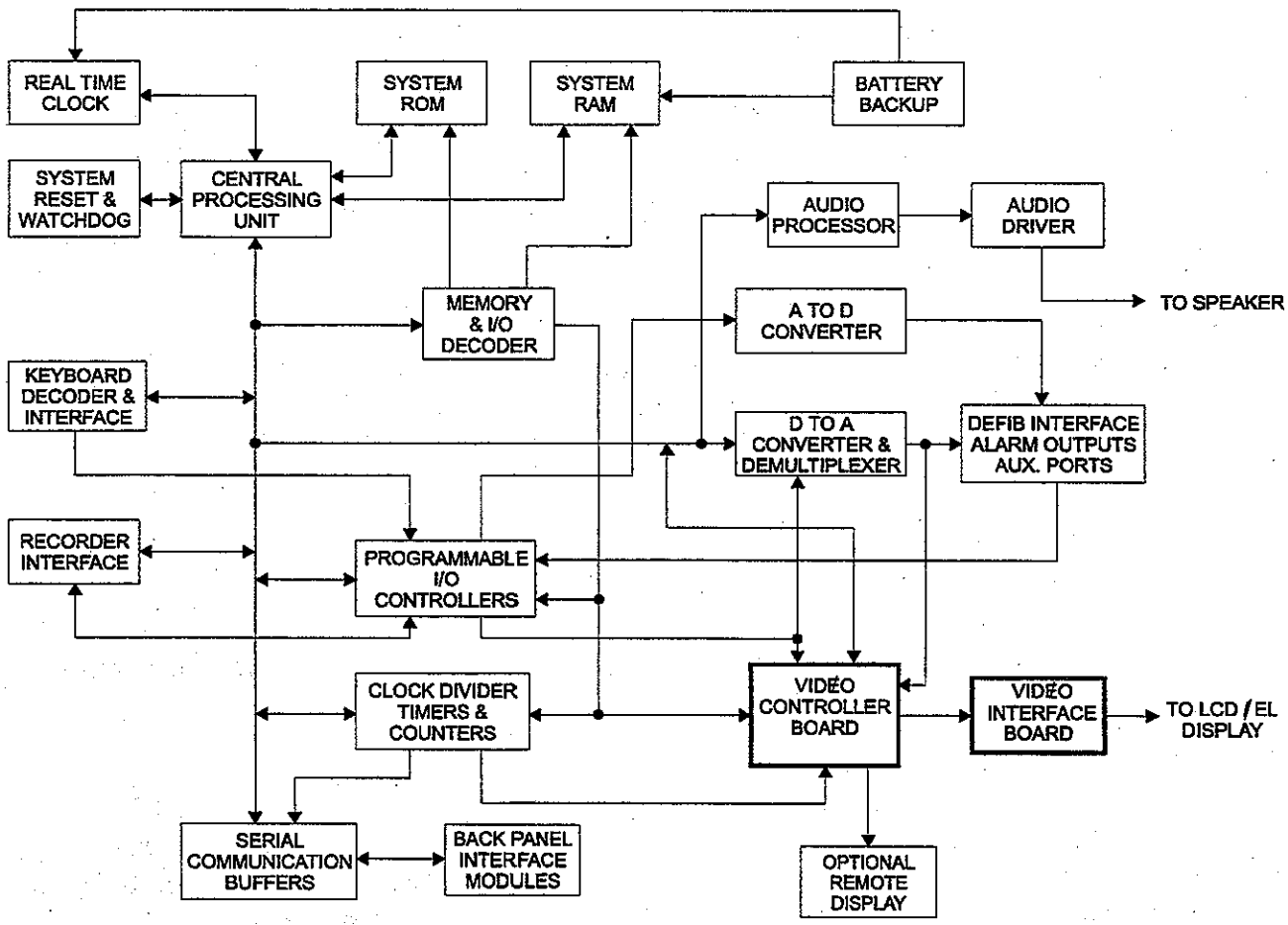


Figure 4-1: CPU Board Block Diagram

4.2 System Processing

4.2.1 Microprocessor

The microprocessor (U5) used on the CPU Board is a Z180 type which includes internal memory management, and DMA control. An external clock is provided using U4, a 32 MHz crystal oscillator. The input frequency is internally divided by two and output on U5-68 as [CLKOUT]. Program instructions are carried on the address lines, A0-A19, and data is transferred using data lines, D0-D7. The [BUSREQ\], [RD\], [WR\], [DREQ0\], [DREQ1\], and [WAIT\] are tied to +5V through pull-up resistors. [INTTICK\], [INTI\] and [DISPINT\] are interrupts to the CPU, and when the CPU receives one of the interrupts, a program to service the interrupt needs to be run. [INTTICK\] on U5-10 is formed at U3-29 and signals that [TIMETICK] has occurred. The [TIMETICK] signal is derived from the PAL (programmable array logic) device U3-40. The frequency of [TIMETICK] is equal to four times (4X) the AC line frequency. A typical 60 Hz system produces a [TIMETICK] frequency of 240 Hz while a 50 Hz system produces a [TIMETICK] frequency of 200 Hz.

The interrupt is cleared from U6-11 with [INTOCLR]. [INT1] on U5-11 is formed at U3-39 and represents recorder synchronization timing. It is cleared from U7-13 with [INT1CLR]. [DISPINT\] on U5-12 is not used. The Read [RD\], Write [WR\], Memory Enable [ME\] and I/O Enable [IOE\] are input to U3 to form the Memory and I/O Decode logic. [RESETP\] is an input from the watchdog timer and is used to reset the CPU. [DREQ0\] and [DREQ1\] are direct memory access request lines used by the display interface. [CPU_TX], [CPU_RXA] and [RTS0\] are used to establish two way communication with the parameter cards.

4.2.2 Watchdog

The watchdog timer, U9, is strobed with the signal [WD] on U9-11. If the [WD] signal (U7-42) stops, the watchdog timer will time out and reset the CPU using [RESETP\]. U9 also monitors +5V. If +5V falls below critical operating level, U9 will apply the voltage from a 2.4-volt NiCad battery (BT1) to the static RAM to retain the configuration information and to the Real Time Clock to retain the correct time and date while the monitor is in STBY condition.

4.2.3 Clock Divider

The PAL, U3, divides the 16 MHz output frequency from the CPU into four different output timing signals 8 MHz, 4 MHz, 1 MHz, and the battery charging synchronization signal, [CHG_SYN], which is approximately 15.6 kHz. These output frequencies are used as timing signals throughout the monitor.

4.2.4 I/O

The Programmable Array Logic (PAL) chip U3 is factory programmed to serve as a peripheral controller. Because the output lines from U3 are connected to the chip select (CS) pins of the peripherals, the CPU can selectively activate the peripherals using the address lines, A12-A15. The Programmable Peripheral Interfaces (PPI), U7 and U6, control the transfer of both data and control words to and from the CPU.

4.2.5 Memory

The 256K x 8 EPROM ,U13, is factory programmed with the software necessary to control the options purchased with the ESCORT monitors. The 128K x 8 static RAM functions as a scratch pad for the CPU and is used to store the users desired configuration information. The information stored in the static RAM is retained when the unit is turned off by using [VBACKUP] from the watchdog circuit.

4.2.6 Real-Time Clock

The Real Time Clock (RTC), U8, has an internal crystal oscillator that will maintain the correct time of day, and the date. The time and date will be displayed on each recorder strip and can be viewed on the PRISM's screen display. When the monitor is turned off, a 2.4-volt NiCad battery (BT1) produces VBATT which becomes [VBACKUP] after passing through the watchdog timer (U9). [VBACKUP] is used to keep the RTC running.

4.2.7 Alarm Tone Generation

A programmable microcontroller, U2, is used to generate all tones for the PRISM. The microcontroller is factory programmed, and it uses one of the pulse-width modulated outputs to drive the speaker.

4.2.8 Analog-to-Digital Converter

The Analog-to-Digital Converter, U16, is clocked by the 1 MHz signal from U3. It is selected by U3 when the I/O is enabled. It is also driven by the signals [IORD\] and [IOWR\] generated from U3. It converts the analog signal [PADL_ECG] to digital form to be used by the CPU.

4.2.9 Timing

Timer / Counter, U1, is CPU controlled and uses 4 MHz as an input to create the power supply synchronization signal, [PS_SYNC] and the timing signal, [TTCLK]. The [PS_SYNC] signal, clocked by the 4 MHz clock and synchronized by the [RESETP] signal, is a 250 kHz signal that is applied to all system power supply generators to keep them switching on the same edge. This reduces beat frequency noise on the waveform signals. The AC detect signal, [AC_DET], after being inverted by U11E, goes to the CLK1 line, U1-18. The CPU will use this information to determine the line frequency and adjust the timing for proper operation. These signals are used by the Video Controller to synchronize memory access time for the generation of the screen display information.

4.2.10 Keyboard Decoder

The keyboard decoder, U19, employs a 4 x 4 XY matrix that scans the keypad at a rate set by C34. C35 biases the internal debounce circuitry. With a key depression, the appropriate XY coordinate information will be loaded to the outputs U19-15 to U19-19 and the data available (DA) line will go low. The [KEYDATA] signal is routed to the CPU; the CPU will respond with a [KEYREAD] signal to U20. U20 will then latches the transfer of the XY coordinate information on to the data bus for processing.

4.2.11 Digital-to-Analog Converter

The digital-to-analog conversion circuitry (U18) is used to convert digital messages from the CPU to an analog format that is routed to the auxiliary port or to the display interface. The analog output from U18 is demultiplexed by U10 and is routed to various areas. The demultiplexer is controlled by the PPI, U6, using the [MUX 1-3] lines, and the [INH] line.

4.3 High Level Outputs

The ESCORT II allows programming and control of three output ports (PORT1, PORT2, and PORT3). These signals originate from the CPU board connector, P1, and are routed to the rear panel connector, P3. See Table 4-1 for pin designations. Each port may deliver any of three signal outputs. The signal can be a waveform output, an alarm-triggered output, or a record-triggered output. The signals can be sent to Nurse Call Panels, Remote Slave monitors, or various recording devices. Interfacing with many of these devices may require the use of the High Level Interface Module (HLIM), P/N E2900-33. Contact MDE Technical Support for ordering information.

The ESCORT II may also be connected to an external defibrillator. When [RING], the external QRS sync signal, goes high, it turns on Q1, which will pull the defibrillator flag signal, [DFIBFLG2], low. The [QRSOUT] signal, if present, can be monitored at P3-11. The analog ground is on P3-15, while the digital ground is on P3-14. The [SLEEVE] voltage level is tied to analog ground through R9. The [TIP], which is the ECG high level output signal, is connected to [HI_LEVEL] through R8.

Each port can be defined by accessing the CONFIG page using the ESCORT II's softkeys. Scaling factors, DC offsets, and coupling for each of the parameters are listed in Table 4-2.

*Note: **The outputs will be clipped if the displayed waveform is clipped. In addition, only one BP can be in full scale mode.***

Table 4-1: Rear Panel Connector — P3, Pin Designations

SIGNAL NAME	REAR PANEL (P11)	SIGNAL NAME	REAR PANEL (P11)
ALRM_O	1	RING	8
PORT1	2	+5 V	9 (limited to .5 A)
ALRM_NC	3	TIP/HI_LEVEL	10
PORT2	4	QRSOUT	11
ALRM_NO	5	DIGITAL GND	14
PORT3	6	ANALOG GND	15

Table 4-2: Parameter Scaling Factors, DC Offsets, and Coupling

PARAMETER	SCALE	DC OFFSET	COUPLING
ECG	1 V = 1 mV	2.5 V	DC
BP (PULSE)	1 V = 100 mmHg	1.6 V	DC
BP (SCALE)	1 V = 100 mmHg	0 V	DC
RESP	1 V = 1 ohm	2.5 V	DC
SPO2	4 V = 100%	0 V	DC
CO2	1 V = 10.1 mmHg	0.2 V	DC
TEMP	1 V = 10° C	0 V	DC
HR	1 V = 51 BPM	0 V	DC

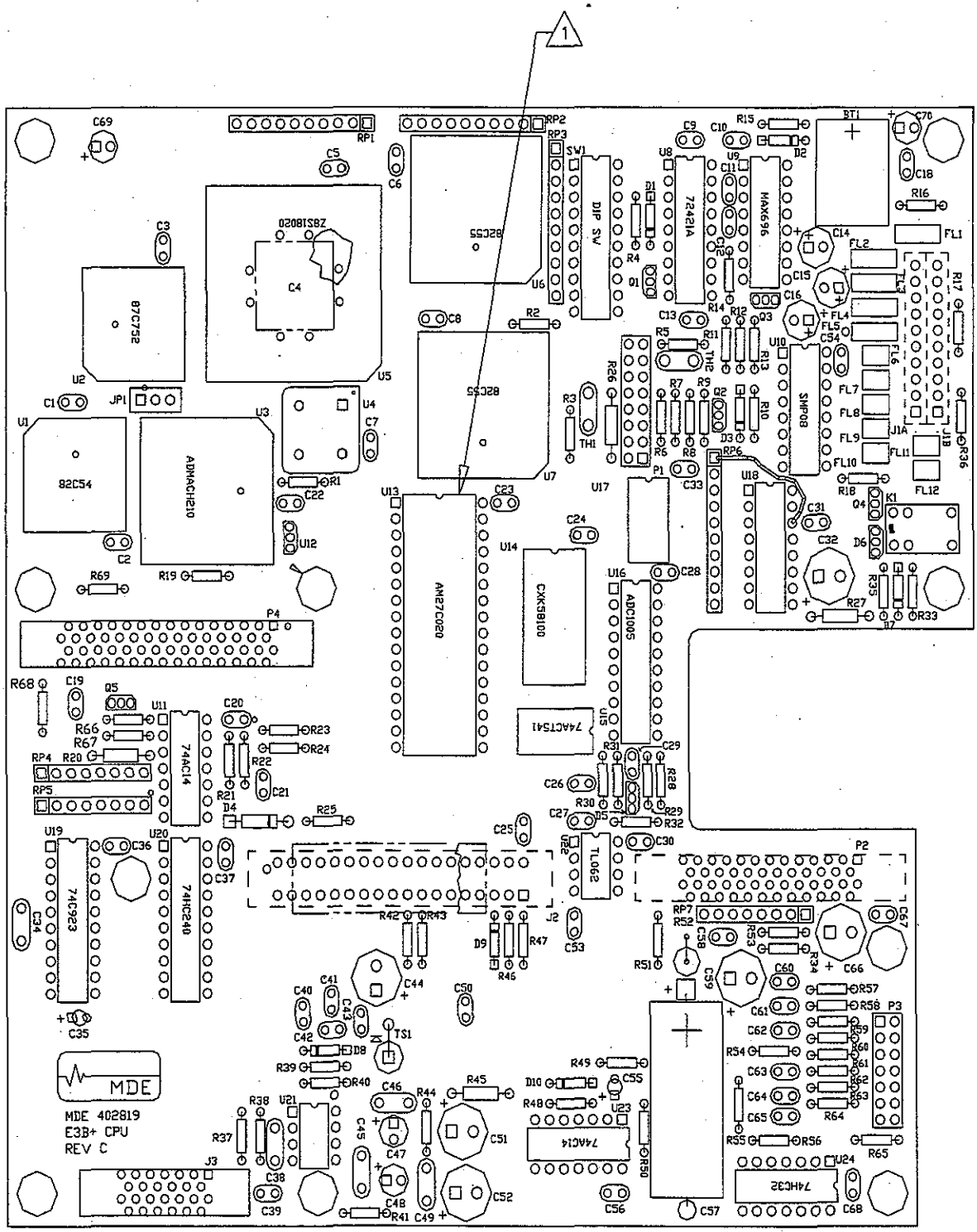
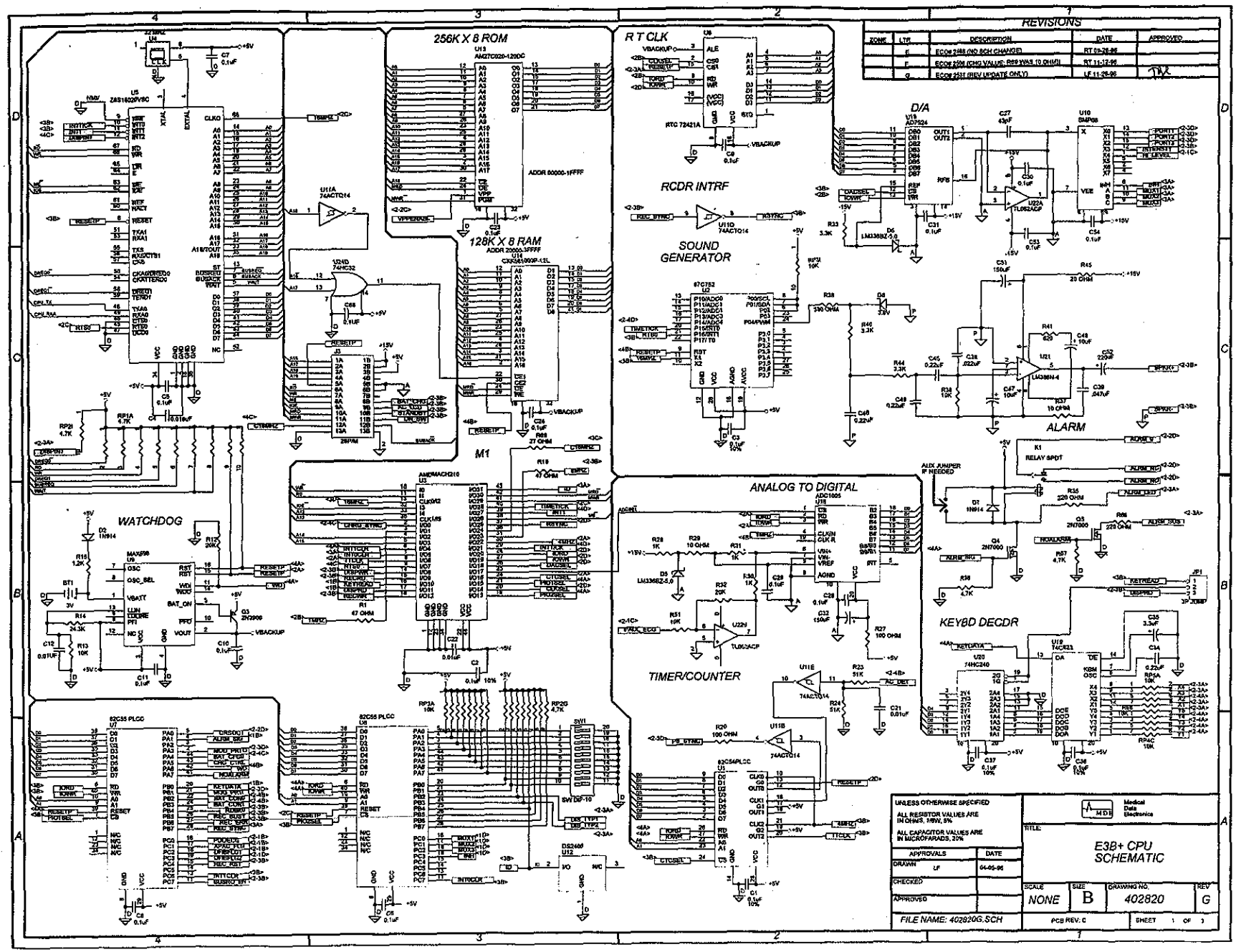
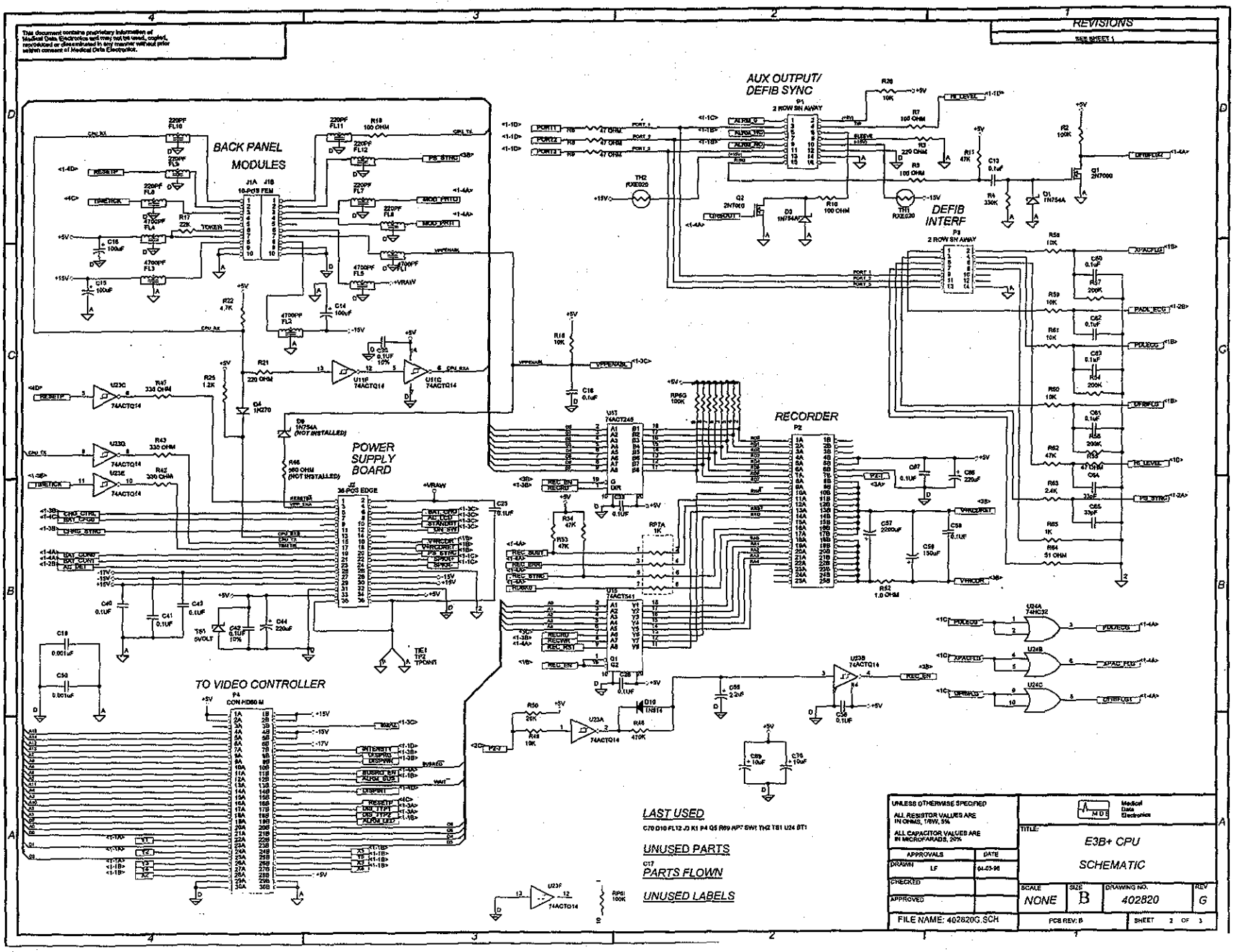


Figure 4-2: CPU Board Layout


REVISIONS
ZONE | LTR | DESCRIPTION | DATE | APPROVED
E | ECO# 2488 (NO SCH CHANGE) | RT 09-26-96
F | ECO# 2506 (CHG VALUE: R69 WAS 10 OHM) | RT 11-12-96
G | ECO# 2531 (REV UPDATE ONLY) | LF 11-26-96
256K X 8 ROM
128K X 8 RAM
R T CLK
D/A
RCDR INTRF
SOUND GENERATOR
ALARM
KEYBD DECDR
ANALOG TO DIGITAL
TIMER/COUNTER
WATCHDOG
M1
UNLESS OTHERWISE SPECIFIED
ALL RESISTOR VALUES ARE IN OHMS, 1/8W, 5%
ALL CAPACITOR VALUES ARE IN MICROFARADS, 20%
APPROVALS | DATE
DRAWN LF | 04-05-96
CHECKED
APPROVED
FILE NAME: 402820G.SCH
Medical Data Electronics
TITLE:
E3B+ CPU SCHEMATIC
SCALE NONE | SIZE B | DRAWING NO. 402820 | REV G
PCB REV: C | SHEET 1 OF 3


REVISIONS
SEE SHEET 1
AUX OUTPUT/
DEFIB SYNC
BACK PANEL
MODULES
DEFIB
INTERF
RECORDER
POWER
SUPPLY
BOARD
TO VIDEO CONTROLLER
LAST USED
C70 D10 FL12 J3 K1 P4 Q5 R99 RP7 SW1 TH2 TS1 U24 BT1
UNUSED PARTS
C17
PARTS FLOWN
UNUSED LABELS
UNLESS OTHERWISE SPECIFIED
ALL RESISTOR VALUES ARE IN OHMS, 1/4W, 5%
ALL CAPACITOR VALUES ARE IN MICROFARADS, 20%
APPROVALS
DATE
DRAWN LF 04-03-96
CHECKED
APPROVED
FILE NAME: 402820G.SCH
Medical Data Electronics
TITLE:
E3B+ CPU
SCHEMATIC
SCALE NONE
SIZE B
DRAWING NO. 402820
REV G
PCB REV: B
SHEET 2 OF 3

402820-0000 PCBA, E3B PLUS CPU REV. G(E2531)

MDE Part Number	Description	Quantity	Reference
352100-0103A	CAP, .01UF,50V,10%,RAD,X7R TAPE & REEL	2	C21,22
352100-0104A	CAP, .1UF,50V,10%,RAD,X7R TAPE & REEL	0	C37,42
352100-0104A	CAP, .1UF,50V,10%,RAD,X7R TAPE & REEL	3	C40,41,43
352100-0104A	CAP, .1UF,50V,10%,RAD,X7R TAPE & REEL	8	C1,2,3,7,20,36
352100-0223A	CAP, .022UF,50V,10%,RAD,X7R TAPE & REEL	1	C38
352100-0224A	CAP, .22UF,50V,10%,RAD,X7R TAPE & REEL	4	C34,45,46,49
352100-0430A	CAP, 43PF,50V,5%,NPO (.1 LEAD SPACING) TAPE & REEL	1	C27
352100-0473A	CAP, .047UF,25/50V,10%,RAD,X7R L.S. .1 IN	1	C39
352101-0102A	CAP,NPO DIELECTRIC,1000PF(.001UF),5%,50V,RAD,.1T&R	2	C19,50
352101-0330A	CAP, 33PF,100V,5%,RAD,NPO TAPE & REEL	2	C64,65
352200-0157A	CAP,150uF,25V,20%,RAD,ELECT,8mm x 12mm,3.5mm LD	3	C32,51,59
352202-0107A	CAP, 100uF,20%,25V,6.3x11mm,RAD,ELECT	3	C14,15,16
352202-0228A	CAP, 2200uF,16V,AX,ELECT,12x30mm	1	C57
352203-0227A	CAP, 220uF,16V,20%.RAD,ELECT,8mm x 12mm T&R	2	C44,66
352206-0227A	CAP, 220uF,20%,25V,ELECT,LOW ESR,8x16mm RAD	1	C52
352300-0103A	CAP, .01UF,50V,20%,RAD,MYLAR	1	C12
352300-0104A	CAP, .1UF,50V,20%,RAD,MYLAR	0	C11,13,18,23,24,25
352300-0104A	CAP, .1UF,50V,20%,RAD,MYLAR	0	C26,28,29,30,31,33
352300-0104A	CAP, .1UF,50V,20%,RAD,MYLAR	0	C53,54,56,58,60,61
352300-0104A	CAP, .1UF,50V,20%,RAD,MYLAR	0	C62,63,67,68
352300-0104A	CAP, .1UF,50V,20%,RAD,MYLAR	27	C5,6,8,9,10
352400-0106A	CAP, 10UF,25V,20%,RAD,TANT	3	C48,69,70
352400-0335A	CAP, 3.3UF,20V,20%,RAD,TANT TAPE & REEL	1	C35
352401-0106A	CAP, 10UF,35V,20%,RAD,TANT TAPE & REEL	1	C47
352401-0225A	CAP, 2.2UF,35V,20%,TANT TAPE & REEL	1	C55
352600-0045A	CAP, 0.039uF,DECOUPLING FOR DIP32	1	C71 (UNDER U13)
352600-0046A	CAP, 0.018uF,DECOUPLING FOR PLCC68	1	C4
354000-0036A	CONN, 2-POS,SGL ROW,.1 ,SHORTING JUMPER	1	(JP1/PIN 2 & 3)
354000-0104A	CONN, SGL ROW,STRT,SGL PINS,SNAP-AWAY 36 PINS	36	JP1
354000-0106A	CONN, DBL ROW,STRT,SGL PIN,SNAP-AWAY 36-PINS	14	P3
354000-0106A	CONN, DBL ROW,STRT,SGL PIN,SNAP-AWAY 36-PINS	16	P1
354000-0199A	CONN, 50-PIN,HIGH DENSITY,MALE	1	P2
354000-0258A	CONN, 36-POS EDGE	1	J2
354000-0259A	CONN, 10-POS, FEMALE	2	J1A,J1B
354000-0260A	CONN, 60-POS HIGH DENSITY,MALE	1	P4
354000-0437A	CONN, 26-PIN,HIGH DENSITY PLUG	1	J3
356000-0043A	OSCILLATOR, 32.000MHZ,DIP METAL CAN	1	U4
360500-0111A	SPCR, #4 x 9/16~LG x 1/4~DIA ALUM,SWAGE	2	2
360500-0112A	STNDOFF, 4-40 x 9/16~LG x 1/4~DIA ALUM,SWAGE	2	3
364000-0027A	IC, 74HC32,2-INPUT ORGATE,DIP-14	1	U24
364000-0096A	IC, 74HC240	1	U20
364000-0123A	IC, RTC 72421A	1	U8
364000-0133A	IC, TL062ACP	1	U22
364000-0137A	IC, ADC1005	1	U16
364000-0155A	IC, 74C923,20-KEY ENCODER,DIP20	1	U19
364000-0197A	IC, SMP08	1	U10
364000-0200A	IC, 74ACTQ14,DIP14,HEX INVRTR W/SCHMITT TRIGGER	2	U11,23
364000-0203A	IC, MAX696	1	U9
364000-0221A	IC, AD7524 CMOS 8BIT BUFFERED MULTIPLYING DAC	1	U18